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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,465	10/29/2003	Yong-Kuk Jeong	SAM-0477	6009

7590 12/20/2005  
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EXAMINER

BLUM, DAVID S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 12/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/696,465

Applicant(s)

JEONG ET AL.

Examiner

David S. Blum

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

Art Unit: 2813

This is in response to the amendment filed 9/19/05.

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 1-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1 and 16 (and therefore all dependent claims) contain the limitation "forming a second electrode...without curing the second dielectric layer after forming the second electrode". The specification as originally presented offers no support for this limitation. The specification (page 10 lines 23-25) discloses that the second dielectric layer is deposited without performing an additional curing process. This does not preclude the practice of performing a subsequent curing step, separate or in conjunction with another step. The issue of subsequent curing of the second dielectric layer is not discussed in the instant specification. The subsequent step of forming an electrode of RuO<sub>2</sub> or IrO<sub>2</sub> by CVD or ALD (page 10 lines 15-20, 30-31) would include an oxidizing atmosphere and is a curing step as taught in Basceri

Art Unit: 2813

(see below). The specification (page 10 lines 23-25) cannot be interpreted as allowing a cure during deposition of the electrode but not after deposition of the electrode but only that the deposition of the electrode does not include a curing step.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-12 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung (US 6,884,675) in view of Basceri (US 6,673,669).

Chung teaches all of the positive steps of claims 1-12 and 14-18 except for forming a second electrode on the second dielectric layer without curing the second dielectric layer.

Regarding claim 1, Chung forms a first electrode on a semiconductor substrate (column 3 lines 8-9), a first dielectric layer on the first electrode (column 3 lines 8-9), cures the first dielectric layer in an atmosphere containing oxygen (column 5 line 32, ozone curing after Tantalum deposition), depositing a second dielectric layer on the cured first dielectric layer using only a source gas (column 5 lines 34-39, second sequence of tantalum precursors, purge gas, flow of reactant gas). Chung teaches curing the second

Art Unit: 2813

dielectric layer prior to forming the second electrode. Basceri also teaches curing the dielectric layer prior to forming the second electrode, or as an alternate embodiment, depositing the second electrode on an uncured dielectric by depositing the electrode with an oxygen atmosphere or diffusing oxygen through the second electrode after deposition (column 5 line 32-column 6 line 4). Curing the dielectric layer by depositing the electrode with oxygen in the atmosphere reads on the limitation of "without curing the second dielectric layer after forming the second electrode". Basceri teaches these methods better fill oxygen vacancies that would migrate toward the dielectric/electrode interface.

Regarding claim 2, the first dielectric layer is formed using only a source gas without a reactant gas (column 5 lines 35-40, ozone is used to cure the deposited layer).

Regarding claim 3, the first and second dielectric layers are formed by CVD (chemical vapor deposition) (column 5 line 7).

Regarding claim 4, the first and second dielectric layers are formed by ALD (atomic layer deposition) (column 5 line 8).

Regarding claim 5, the source gas includes oxygen (column 4 lines 11-13).

Art Unit: 2813

Regarding claim 6, the first and second dielectric layers are deposited at 100-600 degrees C. (column 3 line 44).

Regarding claim 7, the first dielectric layer is deposited to a thickness of 5-200 Å (table I103-244 Å) and the second dielectric layer is deposited to a thickness of 5-3000 Å (Table I 102-228 Å).

Regarding claim 8, the source gas is  $\text{Ta}(\text{OC}_2\text{H}_5)_5$  or  $\text{Ta}(\text{OCH}_3)_5$  (column 4 lines 12-13).

Regarding claim 9, the first dielectric layer is formed of  $\text{Ta}_2\text{O}_5$  using CVD (column 5 lines 7 and 38).

Regarding claim 10, the second dielectric layer is formed of  $\text{Ta}_2\text{O}_5$  using CVD (column 5 lines 7 and 38).

Regarding claim 11, the first and second dielectric layers are deposited in-situ (column 5 lines 13-39), Chung teaches repeating the deposition steps without removal from the chamber or a break in the process, thus it is obvious the two layers are formed in-situ.

Regarding claim 12, the atmosphere containing oxygen is  $\text{O}_3$  (column 5 line 36, ozone is  $\text{O}_3$ ).

Art Unit: 2813

Regarding claim 14, the first electrode is one of Ru, Pt, Ir (column 4 line 37) and the second electrode is TiN or TaN (column 5 line 67-column 6 line 1).

Regarding claim 15, the first and second dielectric layer is Ta<sub>2</sub>O<sub>5</sub> (column 5 line 38).

Regarding claim 16, Chung forms a first electrode on a semiconductor substrate (column 3 lines 8-9), a first Ta<sub>2</sub>O<sub>5</sub> layer is formed on the first electrode (column 3 lines 8-9), cures the first dielectric layer in an atmosphere containing O<sub>3</sub> (column 5 line 32, ozone curing after Tantalum deposition), depositing a second Ta<sub>2</sub>O<sub>5</sub> layer on the cured first dielectric layer using only a source gas (column 5 lines 34-39, second sequence of tantalum precursors, purge gas, flow of reactant gas). Chung teaches curing the second dielectric layer prior to forming the second electrode. Basceri also teaches curing the dielectric layer prior to forming the second electrode, or as an alternate embodiment, depositing the second electrode on an uncured dielectric by depositing the electrode with an oxygen atmosphere or diffusing oxygen through the second electrode after deposition (column 5 line 32-column 6 line 4). Curing the dielectric layer by depositing the electrode with oxygen in the atmosphere reads on the limitation of "without curing the second dielectric layer after forming the second electrode". Basceri teaches these methods better fill oxygen vacancies that would migrate toward the dielectric/electrode interface.

Art Unit: 2813

Regarding claim 17, the first Ta<sub>2</sub>O<sub>5</sub> layer is formed using Ta(OC<sub>2</sub>H<sub>5</sub>)<sub>5</sub> without a reactant gas (column 4 lines 13-14).

Regarding claim 18, the first and second Ta<sub>2</sub>O<sub>5</sub> layers are formed by CVD (chemical vapor deposition) (column 5 line 7).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Chung by forming the electrode upon an uncured (Ta<sub>2</sub>)<sub>5</sub> dielectric as taught by Basceri to better fill oxygen vacancies that would migrate toward the dielectric/electrode interface.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung (US 6,884,675) in view of Basceri (US 6,673,669) and in further view of Narwankar (US 6,677,254).

Chung and Basceri teach all of the positive steps of claim 13 as recited above in regard to claim 1, except for forming the atmosphere containing oxygen being electron resonance or an RF plasma of O<sub>2</sub> or N<sub>2</sub>O.

Regarding claim 13, Chung is silent as to the source of O<sub>3</sub>, and Basceri teaches using O<sub>2</sub>, O<sub>3</sub>, or N<sub>2</sub>O, but does not teach electron resonance or an RF plasma as the method of producing the gas (column 5 line 62-column 6 line 4, suggesting thermal heating).



Art Unit: 2813

Narwankar teaches supplying the gas (O<sub>2</sub>) as a thermal heated operation or in an RF plasma (microwaves column 7 lines 5-20), giving the two heating methods an art recognized equivalence for this operation.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Chung and Basceri by using RF plasma oxygen as taught by Narwankar to be an art recognized equivalent to thermal oxidation for this operation.

### ***Response to Arguments***

6. Applicant's arguments filed 9/19/05 have been fully considered but they are not persuasive.

The applicant argues that Chung does not teach or suggest forming a second electrode on the second dielectric layer without curing the second dielectric layer after forming the second electrode. The examiner has not made such a representation. Rather that Chung teaches multiple dielectric layers and that Basceri teaches not curing the top layer prior to deposition of the second electrode with the advantage of better filling the oxygen vacancies. The combination of Chung and Basceri read on the claims (1 and 16) as currently written.

The applicant argues that Basceri does not teach or suggest forming a second electrode on the second dielectric layer without curing the second dielectric layer after

Art Unit: 2813

forming the second electrode. Basceri teaches curing the top dielectric layer either after deposition of the electrode or during the deposition of the second electrode. Curing the dielectric layer during deposition of the second electrode reads on forming a second electrode on the second dielectric layer without curing the second dielectric layer after forming the second electrode. Further, the instant specification teaches forming an electrode of RuO<sub>2</sub> or IrO<sub>2</sub> by CVD or ALD (page 10 lines 15-20, 30-31). CVD or ALD of RuO<sub>2</sub> or IrO<sub>2</sub> would include an oxidizing atmosphere and is a curing step as taught in Basceri (curing the dielectric layer in an atmosphere containing oxygen during deposition of the electrode)

The applicant argues that neither Chung nor Basceri teach forming a second electrode on the second dielectric layer without curing the second dielectric layer after forming the second electrode. This argument was answered above in regards to Chung and Basceri individually.

The applicant argues that neither Chung or Basceri teach depositing a second dielectric layer on the cured first dielectric layer without a reactant gas. However, Chung deposits the layers using only a source gas and subsequently curing them. Basceri teaches not curing the top dielectric layer prior to deposition of the electrode.

The applicant argues that Narwankar does not teach or suggest forming a second electrode on the second dielectric layer without curing the second dielectric layer after

Art Unit: 2813

forming the second electrode. Narwankar was not cited for this purpose, but rather to teach a limitation regarding the supply of oxygen in a thermal heated operation.

### ***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

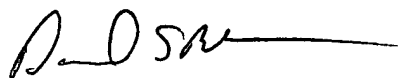
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Art Unit: 2813

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David S. Blum

December 15, 2005